SENCORE

Means Success In Electronic Servicing

tech tips

Learning to Use the LC102 AUTO-Z™

This Tech Tip is a self-study course about the LC102 AUTO-Z capacitor inductor analyzer. We will take you through testing samples of each type of component the LC102 is designed to test. We will then review the important parts of each test.

Gather Samples

The best way to learn the LC102 is by using it on actual components. Before you go any farther, find at least one of each of the following components or use the DM115 Demonstrator:

1. A non-electrolytic capacitor, such as a film or ceramic type
2. An aluminum electrolytic capacitor (any value)
3. A fixed-value coil
4. A good high voltage flyback transformer
5. A piece of solder about 3 inches long

Preliminary Setup

Before testing any components, you should zero the LC102 circuits. Follow these steps:

1. Connect the LC102 test leads.

2. Apply power by momentarily moving the POWER switch to the ON & BATT TEST position. The digital display should become active. If not, check the power adapter connections or battery condition.

3. Clip the two test leads together (short-circuit) and move the LEAD ZERO switch to the SHORT position. A dash will move from left to right in the digital display while the circuits are setting their zero.

4. Unhook the test leads from each other (open-circuit) and move the LEAD ZERO switch to the OPEN position. The dash will again move through the display as the circuits compensate for the open leads.

The microprocessor will now compensate for the test leads. Remember to rezero the unit each time you turn it on. It's also a good idea to rezero it immediately before testing a very small value component, if it has not been zeroed for a half hour or longer, to compensate for the few counts of change which may result from different placement of test leads or slight changes in the input circuits.

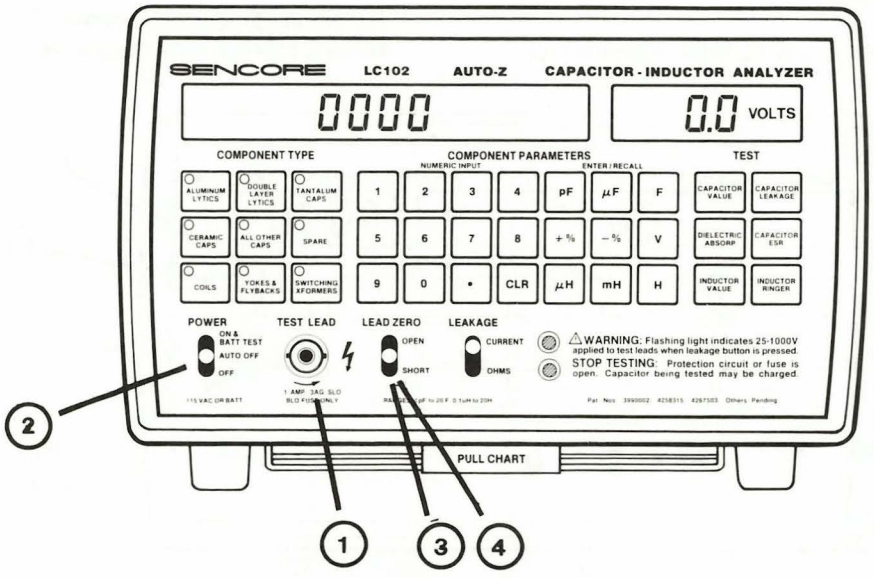


Fig. 1: Before you begin testing components, aply power and zero the leads using the automatic "OPEN" and "SHORT" functions.

Stop Testing Alarm

If the LC102's STOP TESTING alarm activated stop all testing with the LC102. The alarm is activated by either the test lead input fuse opening, protection ciruit opening, or connecting the test leads to a point with 10 volts or greater. The LC102 uses two method to allert you that the alarm has activated, an audible buzzer and a flashing LED.

If STOP TESTING alarm activates:

1. Stop all testing with the LC102.

2. Carefully discharge the capacitor you are testing by connecting a 10 k ohm 1 watt resistor accross the terminals.

3. Replace the test lead fuse if blown, or remove the voltage from the point the test leads are connected to.

4. Resume testing.

Testing Non-Electrolytic Capacitors

We will start aby testing the non-electrolytic capacitor, because it has fewer failure modes than an electrolytic capacitor. Start by indentifying its type, using the guidelines on pages 65 to 68 of the LC102 manual. The charts on these pages explain how to read different codes on the

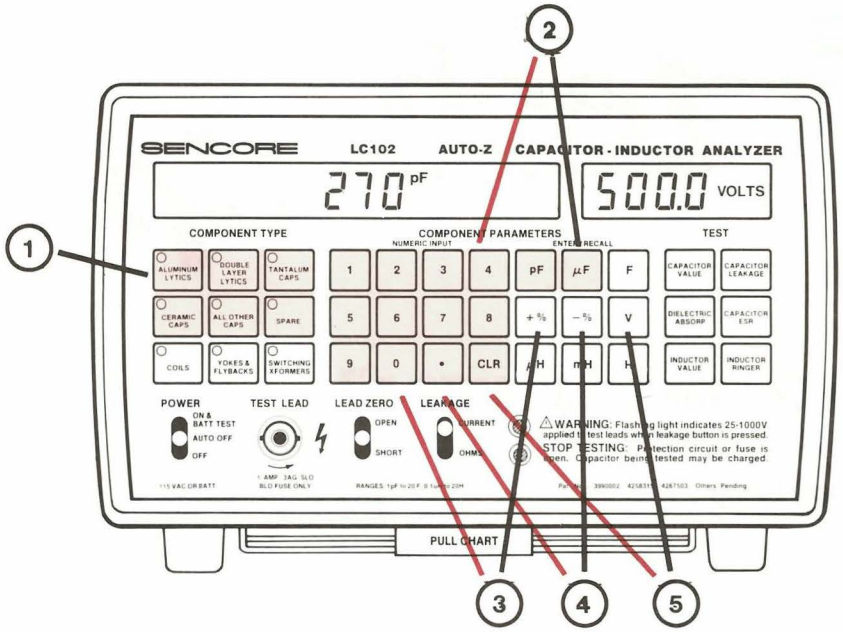


Fig. 2: The LC102's microprocessor uses the data you enter about the capacitor to covert every reading to a GOOD/BAD readout.

capacitor. You'll need this information to enter the ideal values into the LC102.

First, use the touch panel to tell the LC102 about the component you will be testing. The LC102's microprocessor uses this data to tell if the capacitor is within specifications. Follow these steps to program the LC102:

1. Press the beige (tannish colored) COMPONENT TYPE key on the left of the panel which corresponds to the capacitor you are testing.

2. Enter the marked value into the gray NUMERIC INPUT keys, followed by the beige pF or the uF key.

3. Enter the capacitor's positive tolerance into the numbered keys, followed by the white +% key.

4. Enter the capacitor's negative tolerance (this is often the same number as the positive tolerance, but must be entered separately) into the numbered keys, followed by the white -% key.

5. Enter the capacitor's working voltage into the gray keys (use 999 if the rating is 1000 volts or higher), followed by the white V key.

You are now ready to test the capacitor. All non-electrolytic capacitors should be tested for value and leakage. Some (depending on their value) will also be tested for dielectric absorption. Only electrolytics greater than 1 uF, however, should be tested for ESR, so an error message appears in the digital display when testing other types.

To test the capacitor:

1a. Press and hold the beige CAPACITOR VALUE key until a reading appears in the digital display. The value will appear along with the word GOOD or BAD in the right-hand part of the display. The GOOD/BAD results depend on whether the value is within the plus and minus tolerance you entered earlier.

1b. Connect the test leads together to simulate a shorted capacitor. Repeat the test. Notice that the display shows the word SHORT to indicate the failure.

1c. Reconnect to the capacitor leads.

2. Press and hold the beige CAPACITOR LEAKAGE button until a reading appears in the digital display. Continue to hold the key if the reading is larger than zero. Good non-electrolytic capacitors should show no leakage within 2 or 3 updates of the leakage test. If the leakage current remains higher than zero, the capacitor is defective.

3. Press and hold the beige DIELECTRIC ABSORPTION key until a reading appears. (If the capacitor is smaller than 0.01 uF, it is too small to test, so Error 3 appears.) If the dash does not slowly move from left to right through the display, the capacitor still has a charge from the leakage test. Either continue to hold the key, or release the buttons for a few seconds and repeat the test. If a non-electrolytic capacitor shows more than 1% of D/A, it is defective.

4. Press the beige CAPACITOR ESR key. *(Notice that Error 7 appears, indicating that the ESR test does not apply to a non-electroltyic capacitor.)*

Review: Always test non-electrolytic capacitors for **value** and **leakage**. These two tests find most bad capacitors. If a capacitor must store exact values of DC voltage (such as in a sample-and-hold circuit) you can also test for dielectric absorption, as long as the value is larger than 0.01 uF. The ESR test, however, always shows an error when testing non-electrolytic capacitors, because the ESR test is only designed for electrolytics.

Electrolytic Capacitors

The electrolytic capacitor requires all four tests because they can fail in many ways. The initial

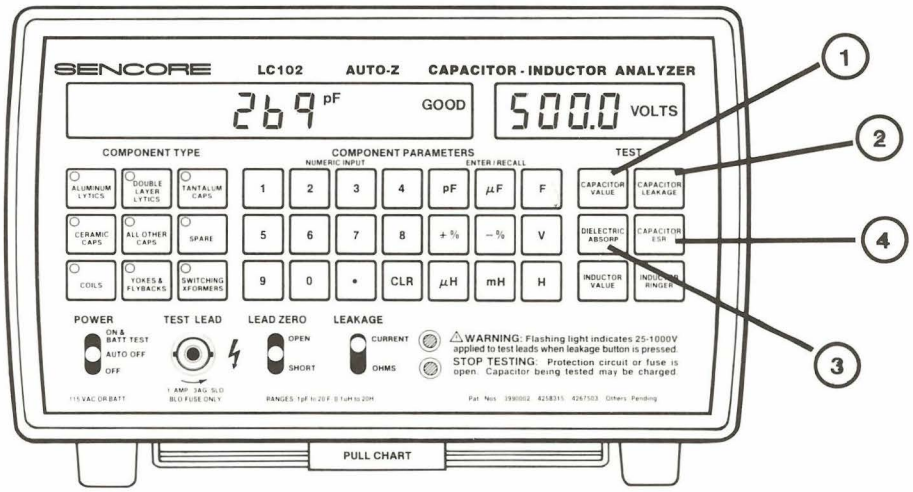


Fig. 3: After connecting the non-electrolytic capacitor, perform the tests in this sequence as you follow the instructions in the body copy.

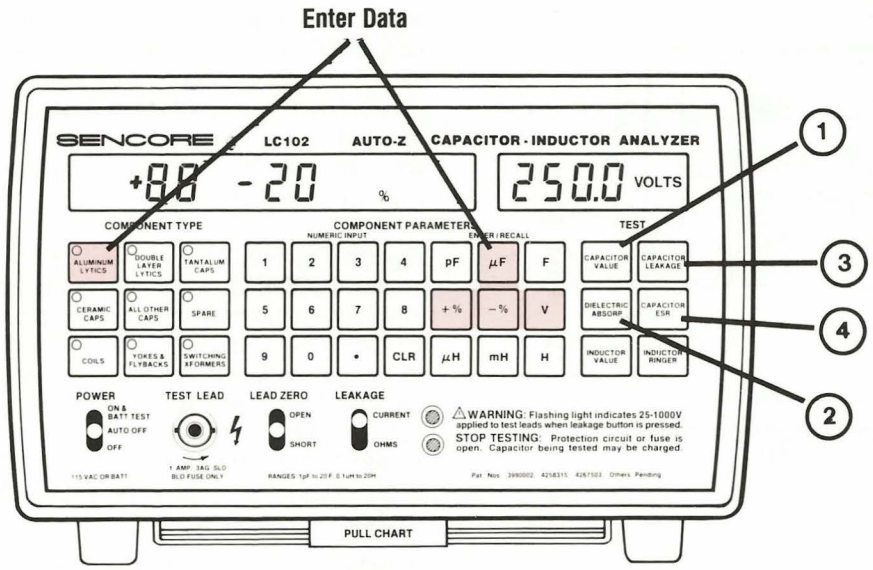


Fig. 4: Enter the data needed to test the electolytic capacitor, and then perform the tests in the sequence listed.

setup will be the same as for other capacitors. Enter the type, ideal value, tolerances, and voltage rating. Typical electrolytic tolerances are +/-20%, +50/-30%, or even +100/-0%. If you don't know the tolerance, use 80 for the +% setting and 20 for the -% inputs, since this is a common electrolytic tolerance.

Be certain you connect the red test lead to the + terminal when testing electrolytic capacitors.

To test the capacitor:

1. Press and hold the beige CAPACITOR VALUE key until a reading appears in the digital display. The value will appear along with the word GOOD or BAD in the right-hand part of the display. The GOOD/BAD results depend on whether the value is within the plus and minus tolerance you entered earlier. Electrolytics normally read higher than marked. (See Tech Tip 102 for more details.)

2. Press and hold the beige DIELECTRIC ABSORPTION key until a reading appears. (It's generally better to test for dielectric absorption before testing for leakage because the capacitor may take several minutes to return to normal after being tested for leakage.) A capacitor with more than 15% D/A is always considered defective. Lower levels may cause troubles in some circuits (such as audio coupling applications), so learn to base your decision on the circuit's performance. If the circuit seems to have a DC upset, suspect dielectric absorption. (See Tech Tip 105 for more details on dielectric absorption.)

3. Press and hold the beige CAPACITOR LEAKAGE button until a reading appears in the digital display. Continue to hold the key for at least 5 leakage updates to see if the reading drops to the GOOD range. (If the capacitor is still showing excessive leakage, it may be defective, or may need reforming. For this demonstration, you may wish to switch to a different capacitor.) If the digital display shows GOOD, the capacitor has passed this test. If the capacitor continues to read BAD, it either needs reforming (see page 51 of the LC102 manual) or it has too much leakage. (See Tech Tip 103 for more details about capacitor leakage.)

4. Press and hold the beige CAPACITOR ESR key. The digital readout will show the series resistance, along with an indication of whether it is GOOD or BAD for the value and voltage rating being tested. Capacitors with too much ESR may work in some low-frequency applications, but will cause trouble in circuits which use either high frequencies or high currents. (See Tech Tip 104 for more details about equivalent series resistance.)

Review: Always test electrolytic capacitors for all four types of failures. Since electrolytic capacitors have wide tolerances, don't worry about the value reading higher or lower than the marked value, unless it is outside the normal tolerances. Failures due to excessive leakage, D/A, or ESR will be more common than value changes, so use them every time.

Coil Testing

When testing fixed-value coils, start with the INDUCTOR VALUE test. You can also confirm the inductor has no shorted turns with the patented INDUCTOR RINGER test. The Ringer works with all coils larger than 10 uH which do not use laminated iron cores.

First, enter the ideal values, using the same procedure as the capacitor section. Be certain that you select one of the blue coil keys. The voltage can be left wherever you've last set it (or at zero if you've just turned on the unit) since it is not used for any of the inductor tests.

To test an Inductor:

1a. Press the blue INDUCTOR VALUE key. If the value is within the tolerances you've entered, the display will show the word GOOD along with the value reading.

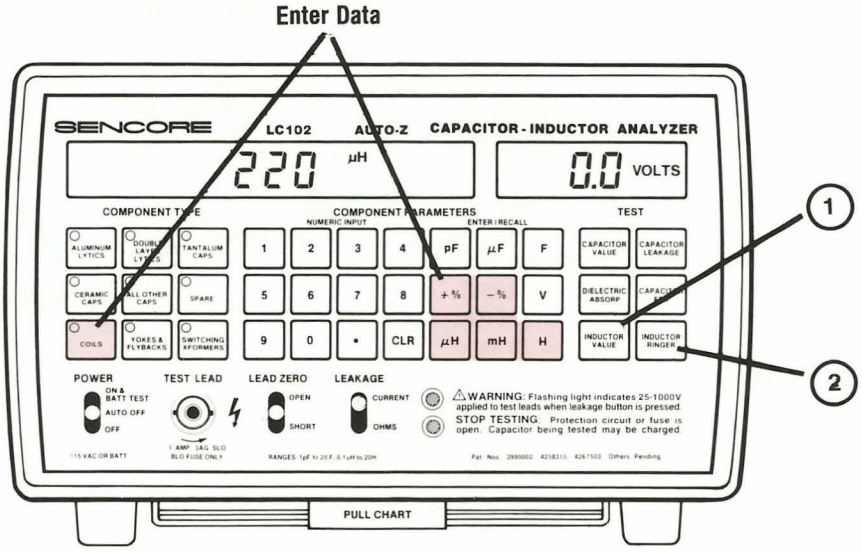


Fig. 5: Select "COILS" for COMPONENT TYPE and then enter the ideal value and tolerances before making the two inductor tests. The voltage may be left any value, since it is not used for any of the inductor tests.

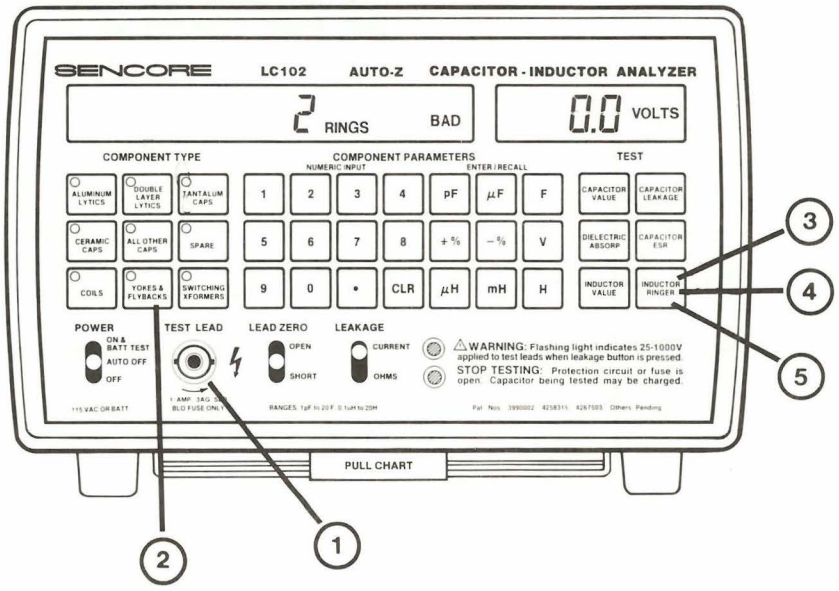


Fig. 6: Select the "YOKES & FLYBACKS" COMPONENT TYPE before connecting to the flyback's primary. Then test it with a loop of solder and jumper across a secondary to simulate defects.

1b. Disconnect one of the test leads to simulate an open coil. Press the INDUCTOR VALUE key. Notice that the word OPEN appears in the display.

1c. Reconnect the coil.

2. If the coil is larger than 10 uH, and it does not used laminated iron, press the INDUCTOR RINGER key. A reading larger than 10 indicates the inductor has no shorted turns.

Review: When you know the value of a fixed inductor, simply use the value test to check if it's within tolerance. Some defects, however, don't affect value, so use the Ringer test. The Ringer test detects shorted turns in most inductors, and reads out in GOOD/BAD results.

Testing Yokes And Flybacks

You don't need to worry about value, resistance, or any other parameter when testing a deflection yoke or a flyback transformer. Simply use the INDUCTOR RINGER test for reliable GOOD/BAD results. In most cases, you only need to connect to the primary of the transformer (the winding connected to the horizontal output transistor) because a shorted turn in\any\of the flyback windings cause\all\of the coils to test bad. You will simulate this with the following procedure:

1. Connect the test leads to the flyback primary.

2. Press the blue YOKES & FLYBACKS COMPONENT TYPE key.

3. Press the blue INDUCTOR RINGER key. The digital display will show a number, and the word GOOD if the number is larger than 10.

4. Wrap a piece of solder around the core of the flyback so that is forms a complete loop (shorted turn). The solder can be anywhere on the flyback (including around the large "doghnut"), as long as it forms a complete loop around the core.

5. Again press the blue INDUCTOR RINGER key. The reading will now be less than 10, and the word BAD will show in the display.

6. Remove the solder and place a jumper across any of the secondary windings. Press the INDUCTOR RINGER key and again notice that the primary rings at a lower number than before. (It may show more or less than ten, depending on how closely coupled the winding and the short are to the core. But, it should always drop the reading if the winding is good.)

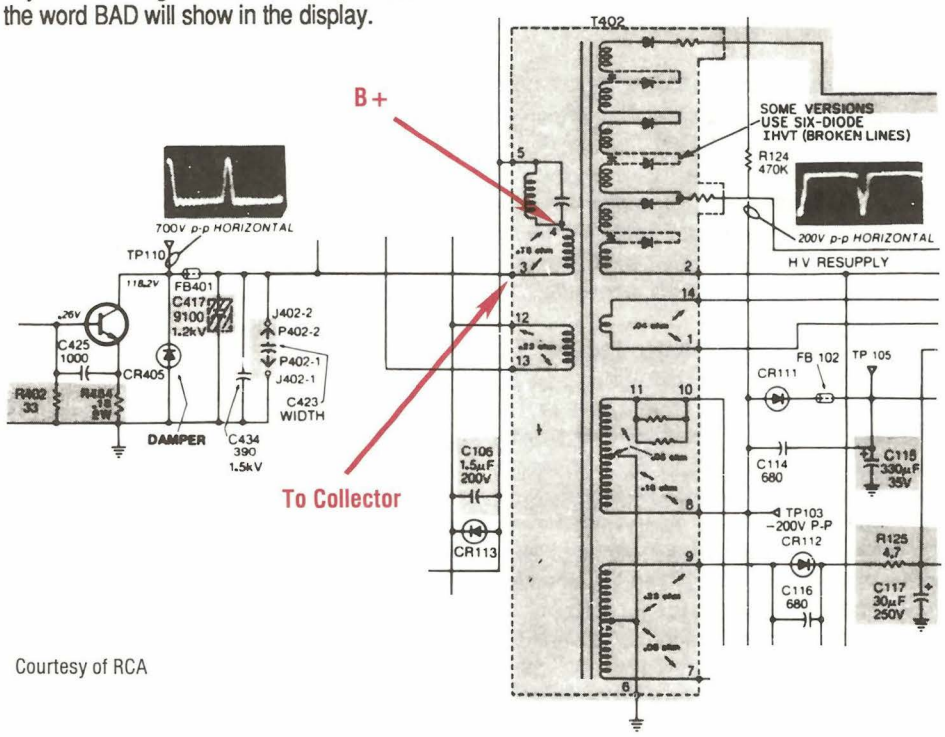
Review: The INDUCTOR RINGER test gives reliable GOOD/BAD results on any deflection yoke or flyback transformer. A short in any winding causes all other windings to show a BAD reading, so it's not necessary to test each winding separately. If you think that a secondary winding might be\open,\simply connect a jumper across it while ringing the primary. If it's\good\the ringing should drop to at least\half\the value before shorting.

Practice With Other Components

Now that you've used all of the AUTO-Z tests, you can gather a pile of assorted components and learn more about them. Try to find some good ones and some bad ones, so that you can see how the tests help you identify defective parts.

For more information
Call Toll Free 1-800-SENCORE
(1-800-736-2673)

SENCORE
3200 Sencore Drive Sioux Falls, South Dakota 57107



Courtesy of RCA

Fig. 7: The primary winding of a flyback transformer connects to the collector of the horizontal output transistor on one end and receives B+ power at the other.

#106 901#